



Static force induces change of circadian clock genes in murine osteocytes might change sclerostin distribution

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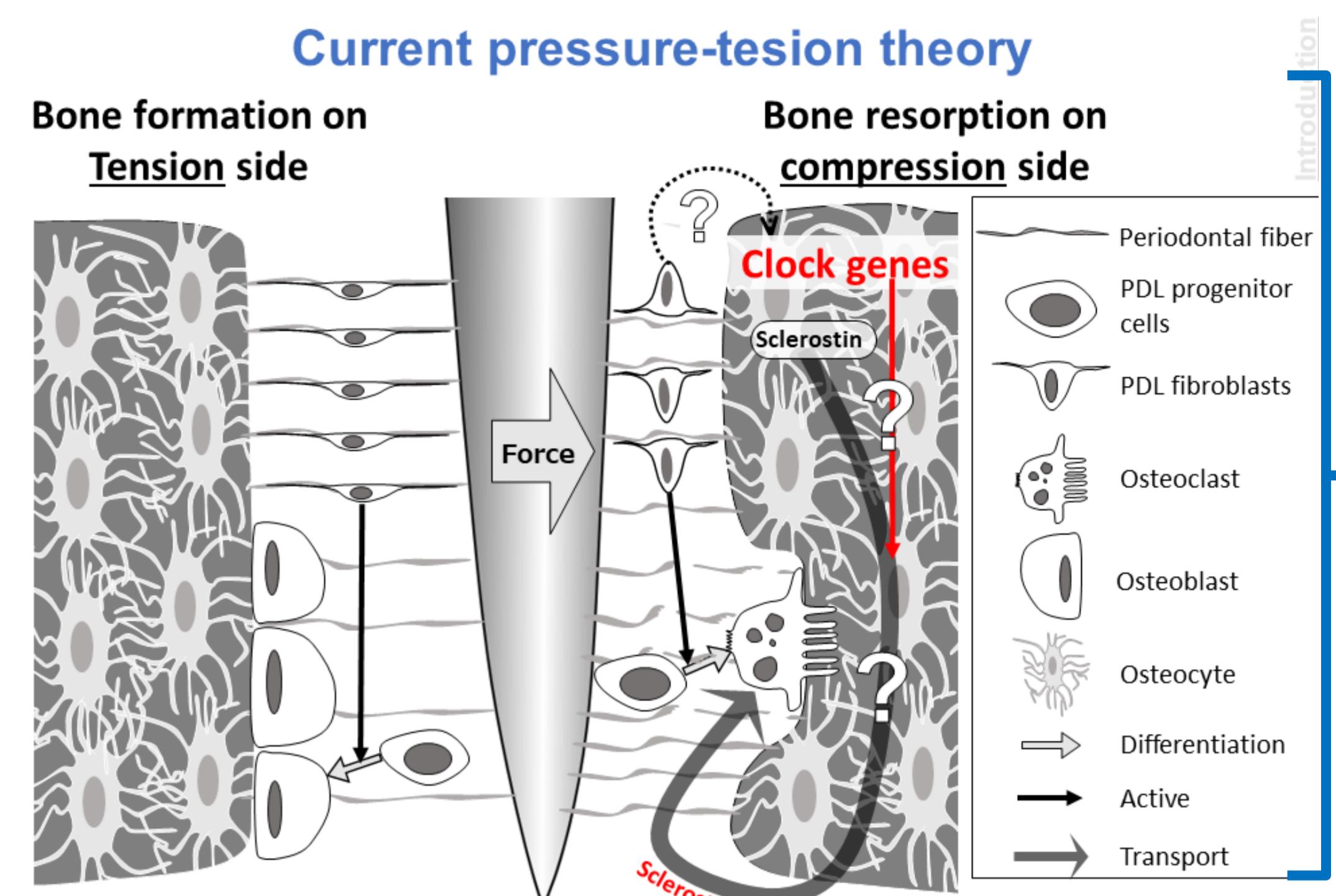


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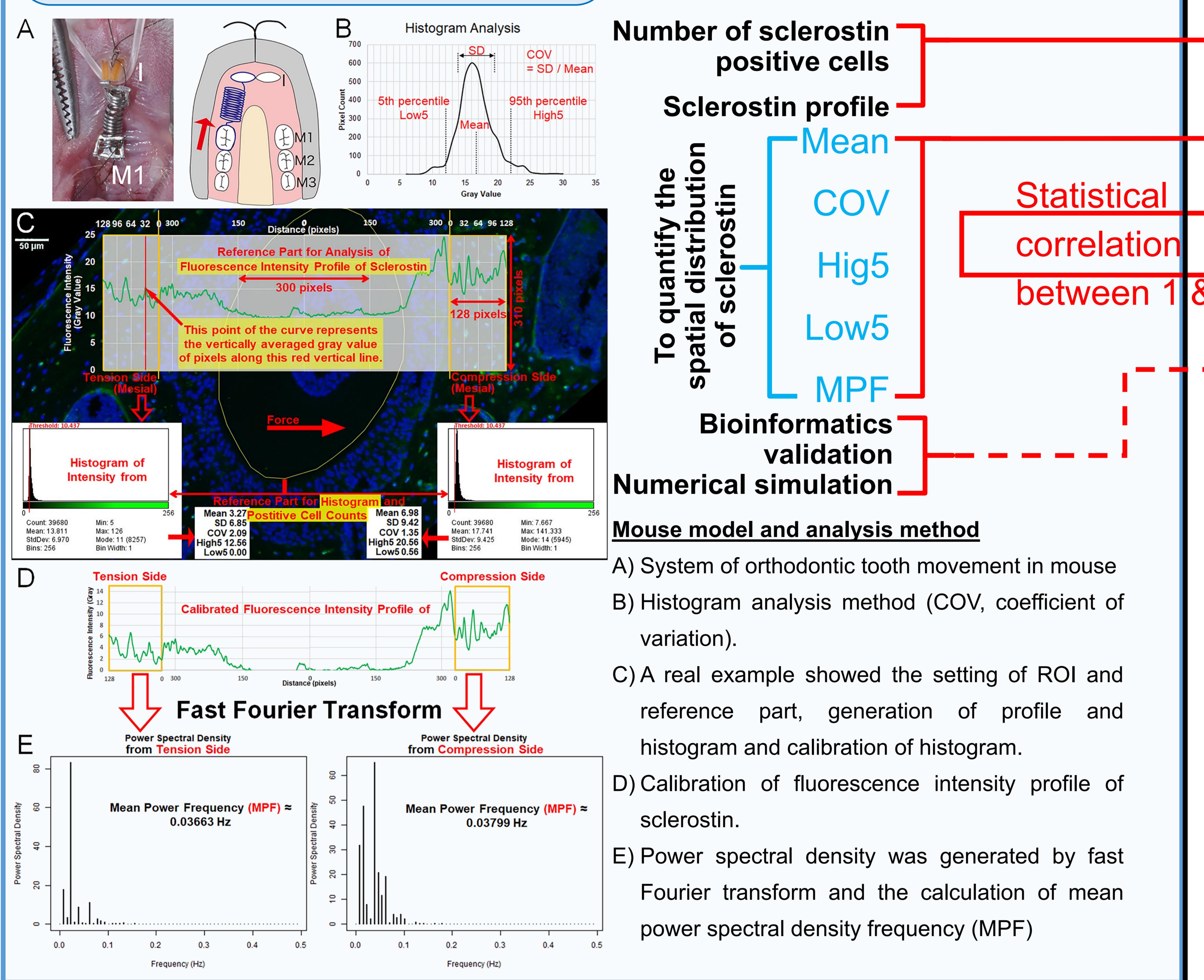
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Introduction

It is well established that osteocytes and their dendritic process network are the main components involved in mechanosensing and mechanotransduction. Sclerostin is a key determinant of the bone mass which mainly produced by osteocytes. The purpose of this study was to investigate the mechano-induced spatiotemporal regulation of sclerostin in alveolar osteocytes generated in response to experimental tooth movement in mice. We also employed an integrative bioinformatics approach to explore potential mechanisms underlying the regulation of sclerostin by bone remodeling and provided a possible association with biological processes related to the peripheral circadian rhythm. Finally, an in vitro co-culture model was applied for the preliminary discussion of the role of periodontal ligament (PDL) cells-osteocytes crosstalk in the mechanotransduction during orthodontic tooth movement (OTM).



Material & Methods



Results

- 1. Expression change of sclerostin in alveolar osteocytes during OTM
- 2. Changes in spatial distribution of sclerostin in alveolar bone during OTM
- 3. Spatial distribution of sclerostin has biological meaning
- 4. Clock genes were possible to regulate the spatial distribution of sclerostin

The immunostaining results (1&2)

- A) The nuclei were stained with DAPI (blue) and the sclerostin were stain in green. Arrows indicate the orthodontic force direction
- B) The double-labeling fluorescence image shows the sclerostin positive osteocytes in alveolar bone.
- C) Sclerostin profile on compression side, tension side and reference part.
- D) Histogram analysis of sclerostin on both compression and tension side.
- E) The mean power frequency (MPF) results.
- F) The percentage of sclerostin positive cells.

Legend

Dark color, Day 0; Red color, Day 1; Green color, Day 5; Blue color, Day 10;

‡, unpaired t-test for the multiple comparisons of the color corresponding Day to Day 0 on compression or tension side;

†, Fisher's LSD t-test in ANOVA for the comparisons of color corresponding Day to Day 0;

*, paired t-test for the comparisons of compression side to tension side at each day.

†, ‡, *, P < 0.05. ††, ‡‡, ***, P < .01; †††, ‡‡‡, ****, P < .001; ††††, ‡‡‡‡, *****, P < .0001.

All the values are the mean ± standard deviation.

Table 2. The results of multiple linear regression^a (34 sections from 18 mice)

	R ²	F statistic	P - Value (F statistic)	Coefficient estimate ± SE	t value	P - Value	Square of semipartial correlations	VIF ^b
The percentage of sclerostin positive cells	0.38	13.067	0.00000093					
Intercept				36.12 ± 5.62	6.43	0.00000002		
The MPF of sclerostin profile				373.25 ± 153.92	2.43	0.01814740		0.06
Mean				1.61 ± 0.31	5.27	0.00000171		1.22
Low5				-1.66 ± 0.34	-3.43	0.00105715		0.11
								1.29

VIF, variance inflation factor; b: VIF higher than 10 suggests a linear relationship between the predictors; SE: standard error.

a: Mixed compression, tension side and every time point; *P < 0.05, **P < 0.01, ***P < 0.001, ****P < 0.0001

Correlation analysis (3)

	Spearman's rank test and multiple linear regression analysis indicated the significant correlation between the number of sclerostin positive cells and the spatial distribution of sclerostin in alveolar bone during OTM.	Factors relative to the percentage of sclerostin positive cells
		MPF of sclerostin profile
		Mean
		SD
		COV
		High5

a: Mixed compression, tension side and every time point. MPF: mean power frequency.

Protein-protein interactions network

